A high-performance carbon-carbon(C/C) Quasi-Solid-State Supercapacitor with Conducting Gel Electrolyte

Dexuan Wang^{1,*}, Liangmin Yu^{1,*}, Benlin He², Lei Wang²

¹ Key Laboratory of Marine Chemistry Theory and Technology, Ministry of Education, Ocean University of China, Qingdao 266100, PR China;

² Institute of Materials Science and Engineering, Ocean University of China, Qingdao 266100, PR China;

*E-mail: wangdexuan@stu.ouc.edu.cn, yuyan@ouc.edu.cn

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The development of the electric double-layer capacitors (EDLCs) that pursue for the advantages of easily carrying, no leaking and high capacitance has been a strong objective at the moment. Here a new type gel electrolyte with a high special conductivity of $15.06 \text{ mS}\cdot\text{cm}^{-2}$ was fabricate by immersing polyacrylamide gel (PAM-G) matrix in 6 M KOH aqueous solution for 60 hours. As expected, the assembled quasi-solid-state supercapacitor based PAM-G electrolyte exhibits a specific capacitance (of $196 \text{ F}\cdot\text{g}^{-1}$ and $156 \text{ F}\cdot\text{g}^{-1}$ at the charge-discharge current density of $1 \text{ A}\cdot\text{g}^{-1}$ and $10 \text{ A}\cdot\text{g}^{-1}$, respectively), maximum power of $10 \text{ kW}\cdot\text{kg}^{-1}$ along with energy density of $28.6 \text{ Wh}\cdot\text{kg}^{-1}$ (under the current density of $10 \text{ A}\cdot\text{g}^{-1}$), and the capacitance retention rate keeps 98% after 5000 cycles at $1 \text{ A}\cdot\text{g}^{-1}$, demonstrating a high cycling stability, an excellent rate capability as well as a high specific capacitance of the device. The promising electrochemical performance could be attributed to the unique homogeneous and microporous three-dimensional structure of the PAM-G which can greatly enhance the permeability and transportation of different ions.

Keywords: Quasi-solid-state supercapacitors; PAM-G matrix; Three-dimensional structure; Energy storage

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